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ABSTRACT

An instructor's manual and student activity guide on power mechanics are provided in this set of prevocational education materials which focuses on the vocational area of trade and industry. (This set of materials is one of ninety-two prevocational education sets arranged around a cluster of seven vocational offerings: agriculture, home economics, distributive education, health occupations, world of work, trade and industry, and office occupations.) The instructor's guide is organized into the following elements: title of activity, duration of activity (four to eight periods), activity goals, instructional objective (build a model rocket and a solar reflector), related vocational clusters, and activity implementation (description, materials needed, safety considerations, teacher preparation prior to class, during the class, follow-up activities, and masters for duplication). The student activity guide provides step-by-step instructions (narrative and illustrations) for completing each instructional objective. At the end of each set of instructions is a student check point (evaluation activity). Occupational descriptions for engineering analyst, power operator, power-plant operator, and power-reactor operator conclude the document. (JH)

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ED169324

T & I, POWER MECHANICS

Kit No. 35

INSTRUCTOR'S MANUAL

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Office of Vocational Education
Prevocational Education
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In Cooperation With

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1978

CE 020 509

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TITLE OF ACTIVITY

Kit No. 35, Power Mechanics (Trade and Industry)

DURATION

Main Activity – 3 to 5 class periods
Follow-up Activity – 1 to 3 class periods

GOALS

The students will understand how persons have developed power to meet their needs.

The students will build a model rocket to show one form of power developed by the human race.

The students will build a reflector grill.

INSTRUCTIONAL OBJECTIVES

The students will build a model rocket from a kit and a reflector grill.

VOCATIONAL CLUSTER

Office Occupations

ACTIVITY IMPLEMENTATION

A. Description

The students will study the development of power and the different ways to produce it. They will build a model rocket kit or reflector grill.

B. Safety

1. Handle tools carefully to avoid injury.
2. Handle rocket fuel carefully.
3. Stay clear of launch pad when launching rocket.
4. Keep others away from launch pad.
5. Launch rocket in a clear opening.

C. Materials Required

1. Audio Visual Equipment
   None
2. Technical Equipment
   5 X-acto knives
   5 pairs scissors
   5 books – Model Rockets for Beginners
   1 rocket launcher and power supply
   10 yardsticks
   5 utility knives
3. Expendable Materials
   Glue
   Sandpaper
   Sanding sealer
   Rocket engines
   Cardboard
   Poster paper or board
   Aluminum foil
   Coat hanger
   Paint brushes

The teacher will need to obtain the materials before class and have students bring coat hangers from home.

D. Preparation Prior to Class

The teacher will need to order rocket kits or make sure the kits are available at a hobby store. It is also possible for students to build a rocket from a book such as Model Rockets for Beginners. Students could select the kit they wish to build according to their individual ability. Estes Alpha III is recommended.

Divide the class into groups of two or three to work on each kit or have student do an individual kit.

Pick a place to launch rockets.

E. During Class Session

INTRODUCTION – Power has been an important part of humanity's advancement. There are many different sources of power. The seven most talked about are (1) people and animals, (2) water, (3), wind, (4) steam, (5) internal-combustion engines, (6) electricity, and (7) atomic energy. Now let's take a brief look at each source.

1. People and Animals. Animals were humans' first use of power. They were used to haul things, plow fields, and to transport persons.
2. Water. Water is used to generate electrical energy. It was used to turn wheels and to grind grain.
3. Wind. Wind was used to turn windmills to pump water. It was also used to power ships.
4. Steam. Steam became an important

source of power when the steam engine was invented. It was used to power trains and ships and to generate electricity.

5. Internal-Combustion Engines. These engines replaced the steam engine because they were less expensive to operate and they were safer to use. These engines are used in cars, trucks, and airplanes.
6. Electricity. It has become one of our main sources of power. We use electricity for lighting, heating, cooking, and operating motors and appliances.
7. Atomic Energy. It is becoming a main source of power. The splitting of the atom produces heat to generate electricity and run ships. Atomic energy is used to launch rockets.

Now that we have looked at different sources of power, we are ready to build and launch a model rocket. Another activity is to build the reflector grill.

While the students are working on rockets or grill, the teacher needs to move around the room to check students' work and answer questions.

F. Follow-up Activities

Study VIEW Fact Sheet
Do research on some type of power; for example, sun, wind, water.

MASTERS FOR DUPLICATION

VIEW Fact Sheet
Master Pattern Sheet

VIEW FACT SHEET

NAME _____ CLASS _____ OCCUPATION _____

A. List the advantages (good points) of this occupation (job).

B. List the disadvantages (bad points) of this occupation (job).

C. List three things you should know to do this occupation (job).
1.
2.
3.

D. What type of education should you get to be prepared (do) for this occupation (job)?

E. What courses must you take to go into this occupation (job)?

F. What do you think your future in this occupation (job) will be?

G. What wage can you expect in this occupation (job)?

H. What are the working hours of this occupation (job)?

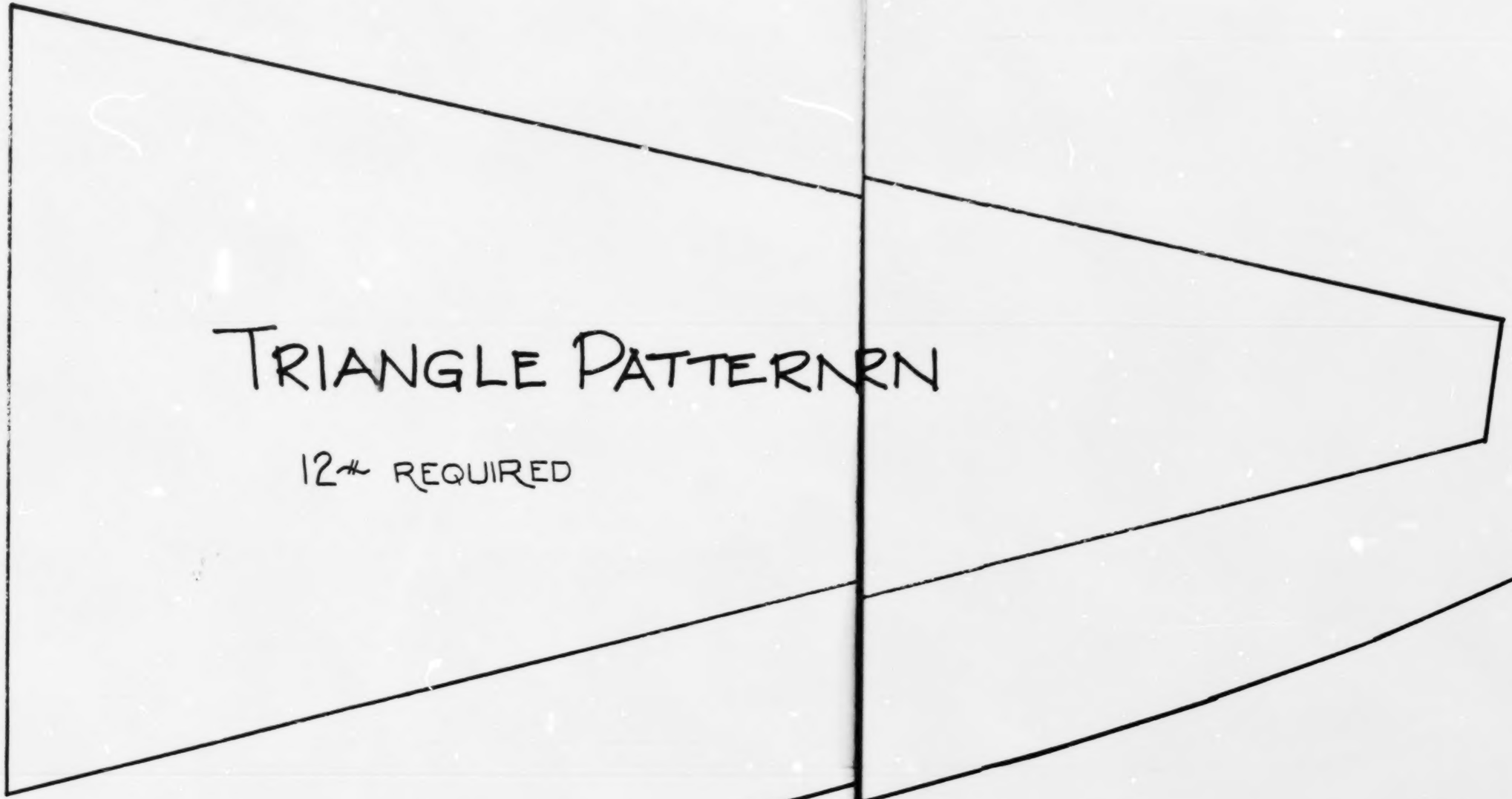
I. To learn more about this occupation (job), write to:

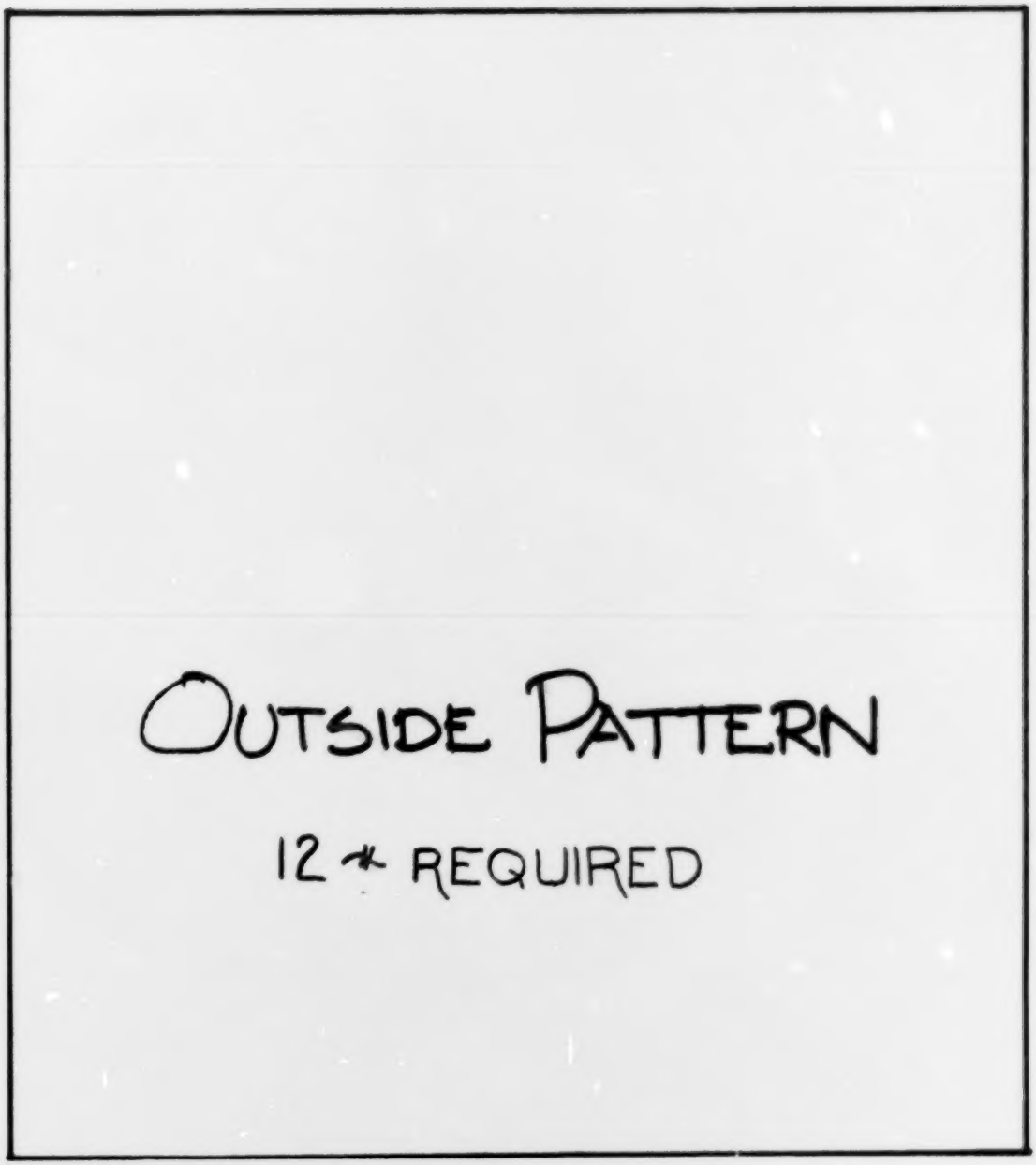
J. Using a scale of 1 to 5, circle the number that measures your interest in this occupation (job) as a possible career.

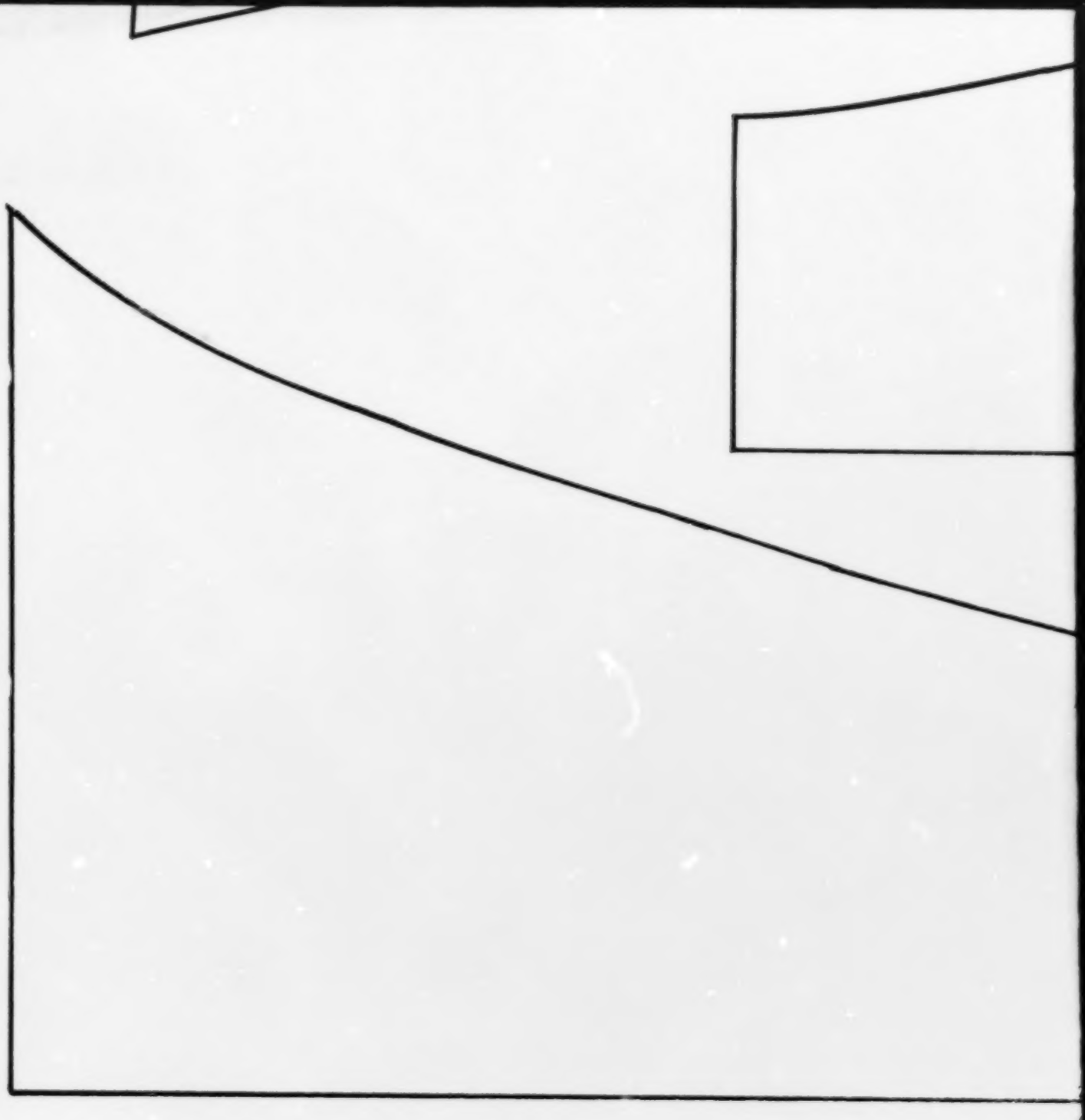
I don't like it. 1 2 3 4 5 I like it.

TRIANGLE PATTERN

12" REQUIRED

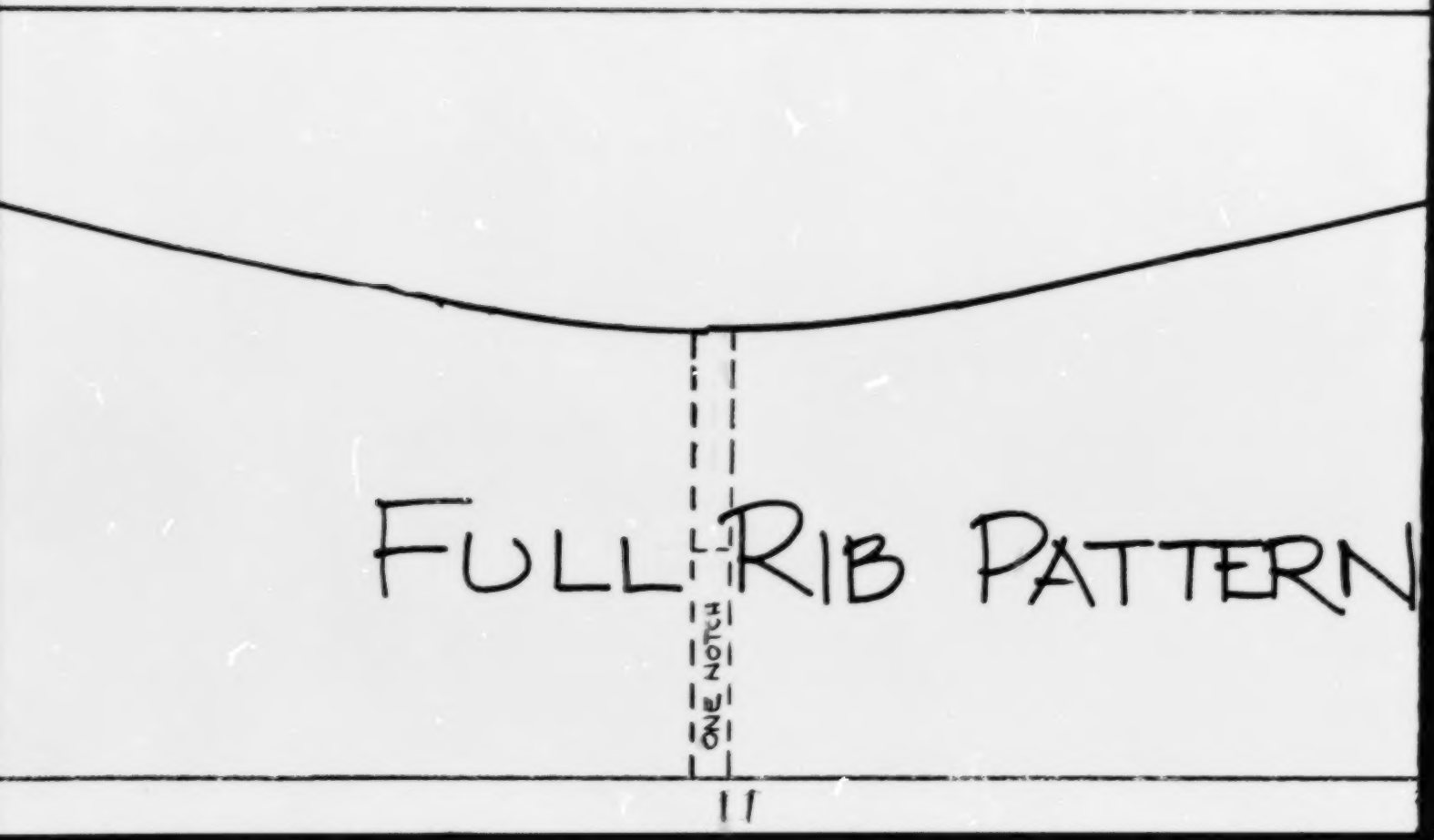



OUTSIDE PATTERN
12 ✱ REQUIRED

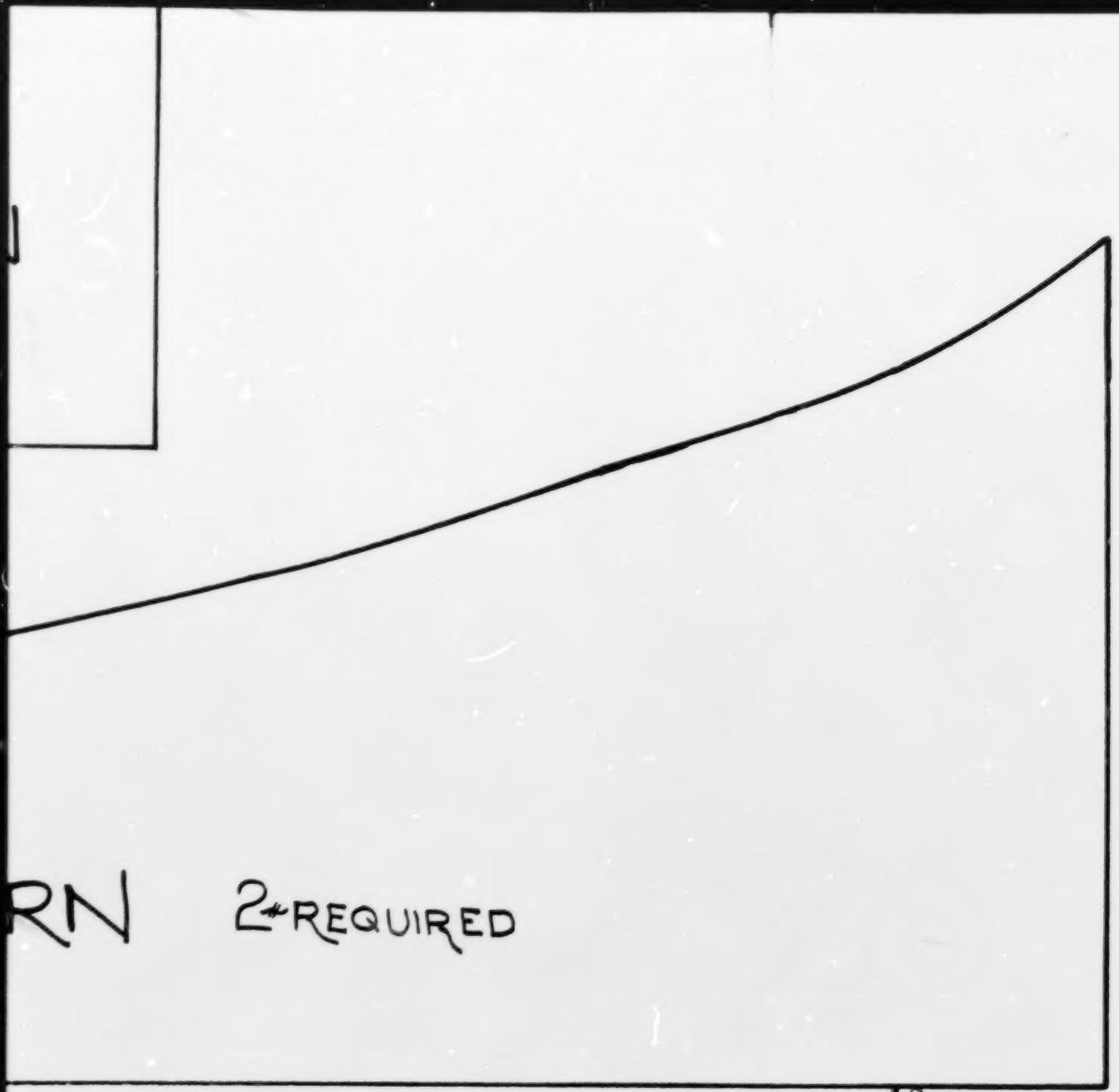


HALF RIB PATTERN

8 REQUIRED



FULL RIB PATTERN


RN
2" REQUIRED

T & I, POWER MECHANICS

Kit No. 35

STUDENT
LEARNING ACTIVITY GUIDE

Prepared by

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MODEL ROCKET

INTRODUCTION

This activity provides a study of power. You will learn different ways to produce power. This kit will provide you with a hands-on experience of building a model rocket.

GOALS

The students will understand how persons have developed power to meet their needs.

The students will build a model rocket to show one form of power developed by the human race.

DIRECTIONS

The students will follow the directions in the kit that is assigned to be built.

The students will read the directions carefully before starting to build the kits.

MATERIALS

Obtain the model rocket kit from the instructor. Read the directions. Obtain the following materials from the teacher as they are needed:

X-acto modeling knife
Paint brush
Scissors
Glue
Sandpaper
Sanding sealer
Yardstick
Pencil (provided by teacher)

PROGRAMMED TEXT

The student will use the instructions in the purchased rocket kit as the programmed text for this activity.

SOLAR REFLECTOR GRILL

INTRODUCTION

The student will build a reflector grill or cooker. The reflector grill uses the sun to cook the food. It is built with the following materials: cardboard, poster board, aluminum foil, and coat hangers.

GOALS

The student will use a ruler to measure the material.

The student will cut the material as needed.

The student will assemble the parts to make a reflector grill.

DIRECTIONS

Read through the step-by-step instructions carefully before you start.

Hold pieces in place until the glue starts to dry.

Follow each step carefully.

Handle tools carefully to avoid injury to yourself and others.

Place cardboard under the piece you are cutting to avoid damaging the table or floor.

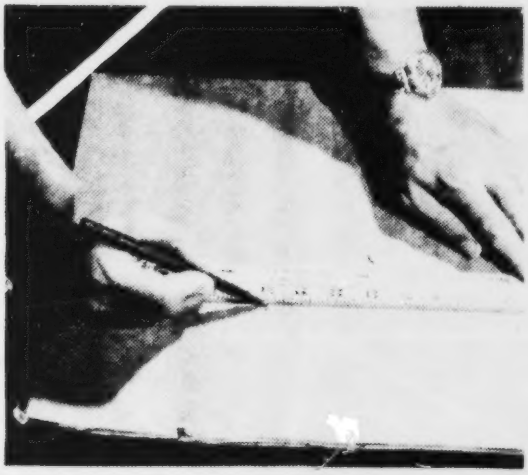
MATERIAL

You will need to obtain the following materials:

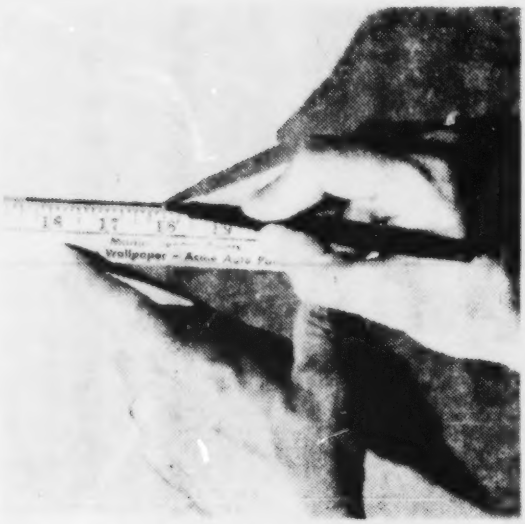
Cardboard
Poster board
Aluminum foil
Coat hanger
Glue
Utility knife
Yardstick
Scissors
Pencil

Instructional Objective 1

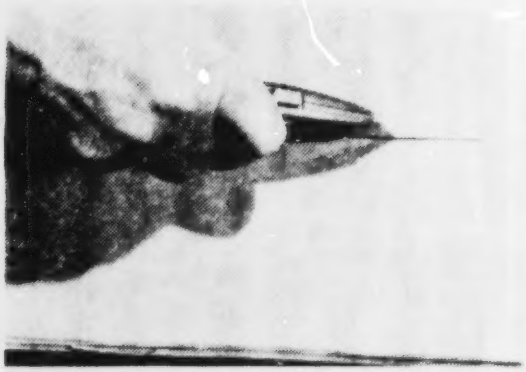
The student will make the base of the reflector grill.



STEP 1 – Using the yardstick, measure and mark 24" (60.96 cm) on each side of your cardboard.



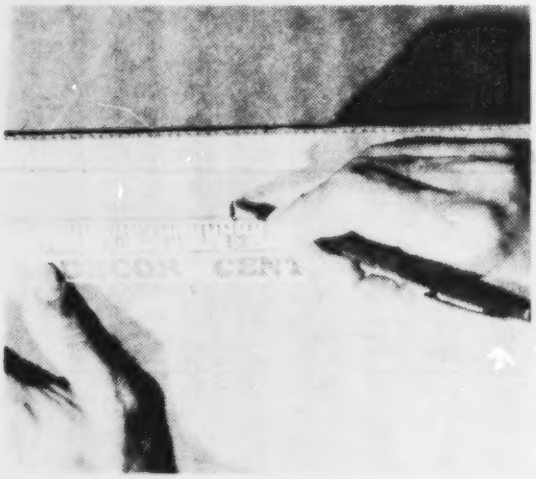
STEP 2 – Place the yardstick on each mark and draw a line using the yardstick as a guide.



STEP 3 – Use the utility knife to cut along the line. Place extra cardboard under the one you are cutting to avoid damage to the table or floor.

REPEAT STEPS 1, 2, & 3

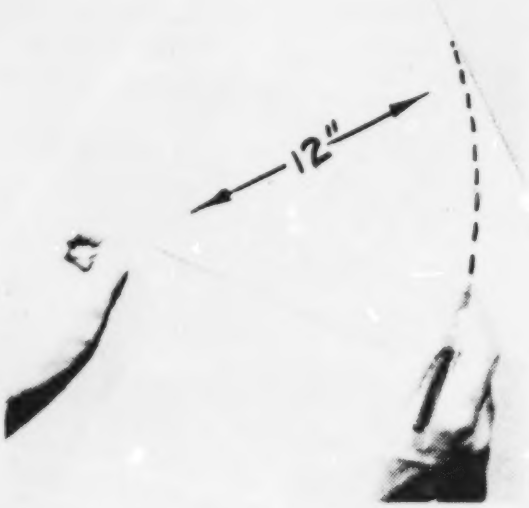
STEP 4 – Repeat steps 1, 2, and 3 to obtain a 24" (60.96 cm) square.



STEP 5 – Using the yardstick, measure and mark 12" (30.48 cm) on all four sides.

16

STEP 6 – Using the yardstick, draw a line connecting the marks opposite each other.



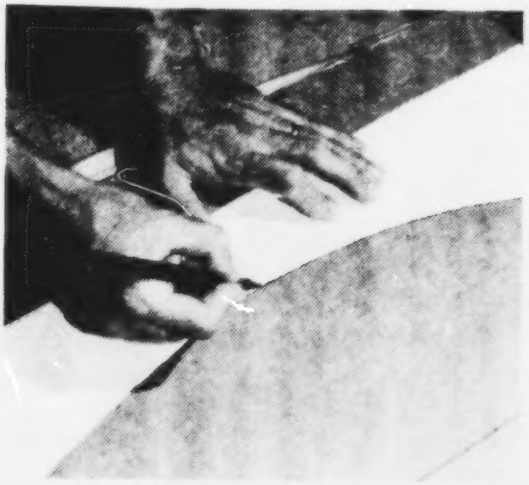
STEP 7 – Using a string, draw a circle on the base. Wrap one end around the pencil, and hold the other where the lines cross.

Check Point

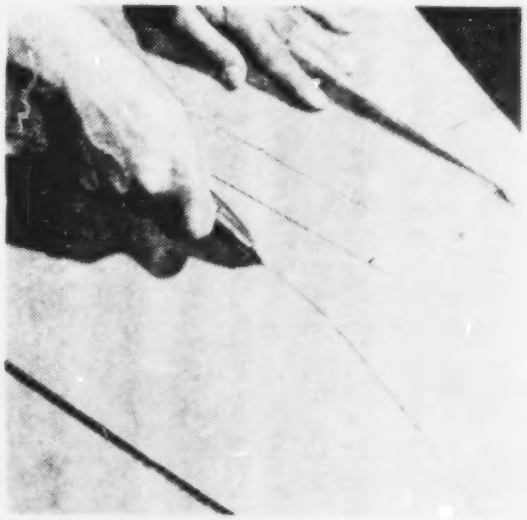
Ask another student to check all the measurements.

Instructional Objective II

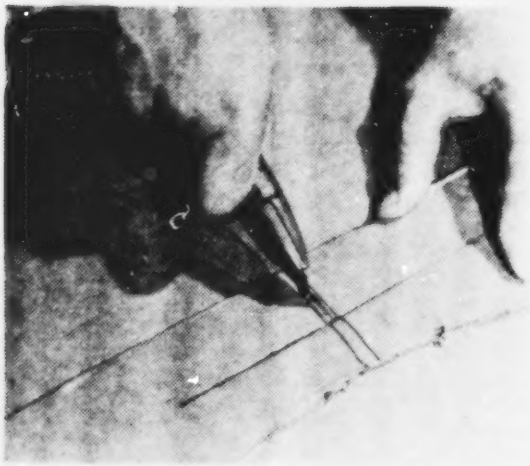
The student will make the two main ribs to put on the base.



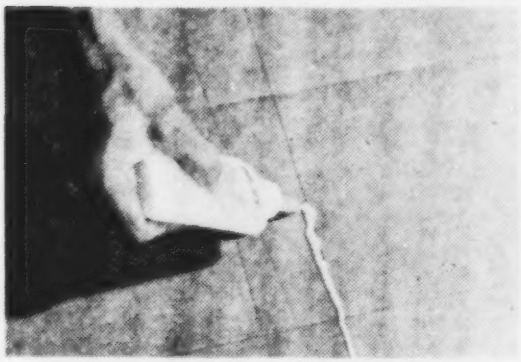
STEP 1 – Using the pattern obtained from the teacher, trace two of the full ribs on a piece of cardboard.

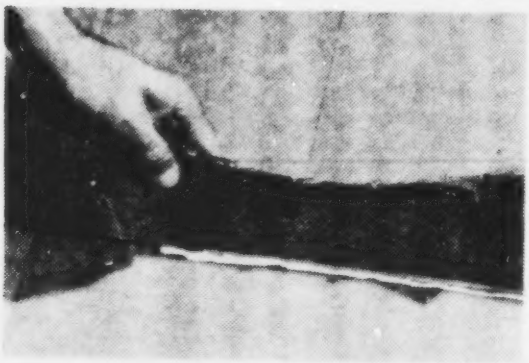


STEP 2 – Using the utility knife, cut along the line until you have cut out the rib.

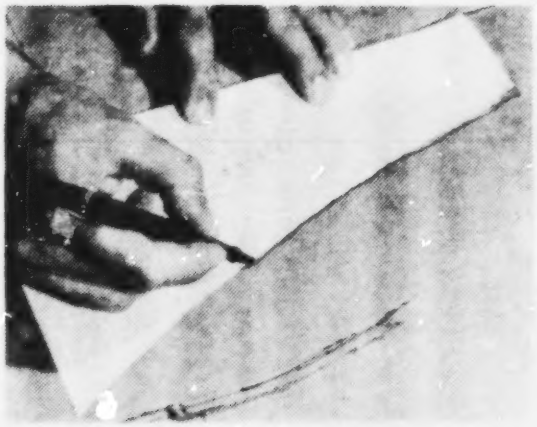


STEP 3 – Cut a slot in the center of each rib. One slot should be on top of one rib and the other slot should be on the bottom of the other rib.

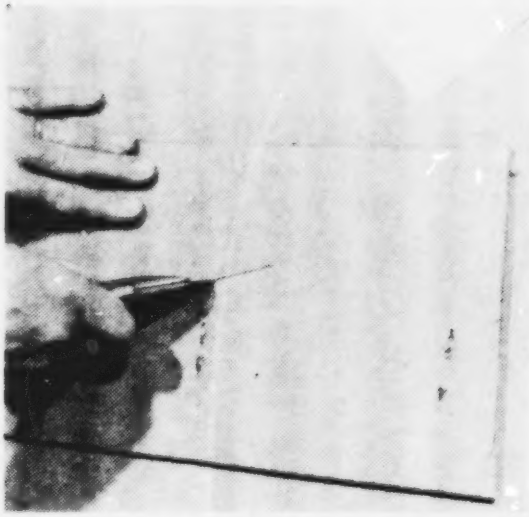




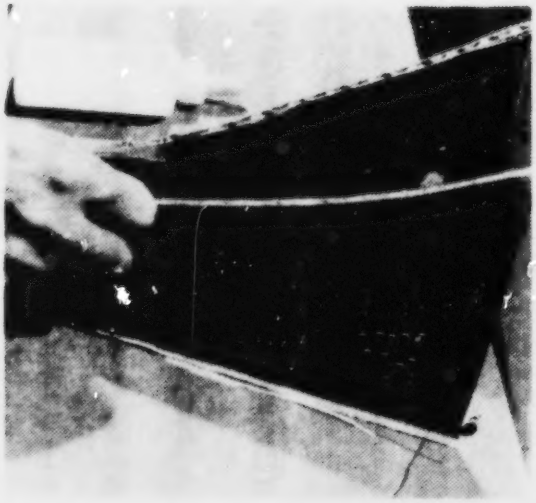
STEP 4 – Place glue along the two lines, and place the two full ribs in the correct place.



STEP 5 – Using the pattern obtained from the teacher, trace eight half ribs on the cardboard.



STEP 6 – Use the utility knife to cut the half ribs.



STEP 7 – Glue the half ribs on the base. There should be 6¼" (15.875 cm) between each rib where it comes into contact with the circle.

Check Point

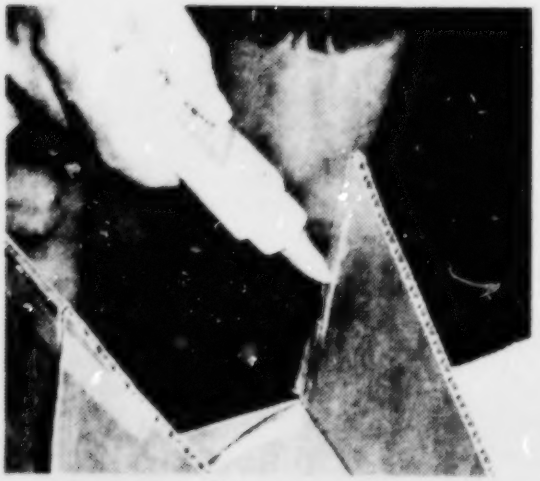
Are all eight half ribs uniform (the same) size?

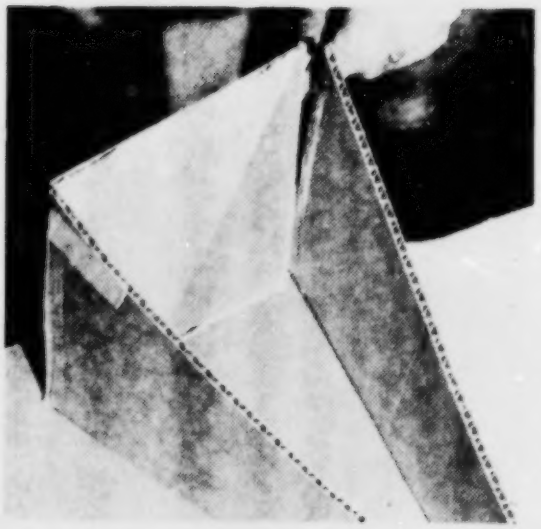
Instructional Objective III

The student will cut and glue the outside of the frame in place.

STEP 1 – Obtain the pattern from the teacher and trace 12 rectangular sides on the cardboard.

STEP 2 – Use the utility knife to cut the rectangular sides. Check to see if the sides fit. If they do not fit, mark and cut to size.





STEP 3 – Glue side into place.

Check Point

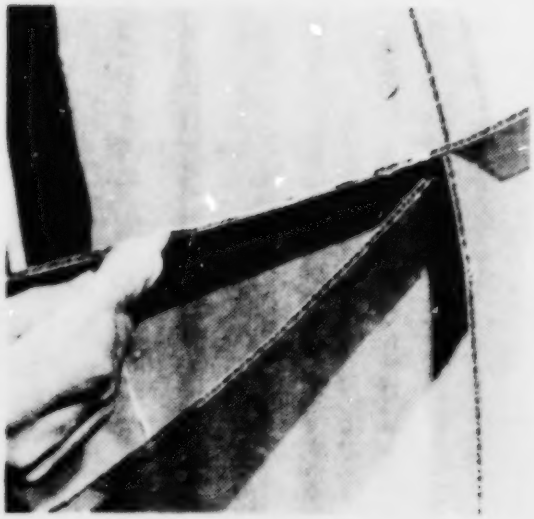
Area all glued joints secure?
If not, glue any loose joints again.

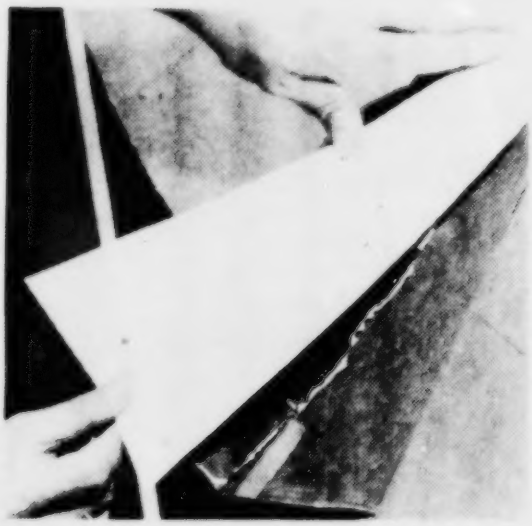
Instructional Objective IV

The student will cut and glue the poster board in place.

STEP 1 – Obtain the triangle pattern from your teacher and trace 12 copies on poster board.

STEP 2 – Using the scissors, cut the poster board.





STEP 3 – Glue the poster board in place. The poster board should overlap the piece put on before it.

Check Point

Wait until the glue sets up and check the structure for strength.

Instructional Objective V

The student will cut and glue the aluminum foil in place.

STEP 1 – Use the same pattern that was used to cut the poster board; trace the pattern on the aluminum foil. You will need to trace 12 of them.

STEP 2 – Use the scissors to cut the aluminum foil.

STEP 3 – Put glue on the poster board and place aluminum foil on the poster board.

Check Point

Check all corners for a proper seal.

Instructional Objective VI

The student will put the coat hanger into the center of the reflector.

STEP 1 – Use a sharp object to punch a hole in the poster board.

STEP 2 – Place the coat hanger in the hole.

Check Point

Make sure that the coat hanger is straight before placing it in the hole.

NOW YOU ARE READY TO USE YOUR REFLECTOR GRILL.

HOW TO USE
THE REFLECTOR GRILL

Take the grill outside and point the coat hanger toward the sun until there is no shadow. Place grill against a chair to hold it at the correct angle. Take a small piece of construction paper (4" x 4")(10.16 cm x 10.16 cm) and place over coat hanger. Move the construction paper down the coat hanger until you find the correct focal point. Now cut the coat hanger off at this point. This is where you hold your food to cook it. You can use a coat hanger to hold your food while cooking hotdogs or rotating (roasting) marshmallows.

020.067-010 ENGINEERING ANALYST (profess. & kin.) applied mathematician; computational engineer; computing analyst; systems analyst, engineering-scientific.

Conducts logical analyses of scientific, engineering, and other technical problems and formulates mathematical models of problems for solution by digitial computer: Analyzes assigned problem, such as optimal design configuration of ballistic missile or computer system for industrial process control. Consults with engineering or scientific personnel to refine definition of project and prepare mathematical simulation of physical system under study. Searches library for applicable mathematical formulations and data pertinent to problem. Prepares mathematical model of problem area, such as set of partial differential equations to relate constants, and variables, restrictions, alternatives, objectives, and their numerical parameters, and inserts relevant data. Reduces problem to computer-processable form, utilizing knowledge of numerical analysis. Confers with originator of problem, using knowledge of subject sciences and their language, to discuss adequacy and applicability of computer output or need for reformulation of model. Prepares reports. May use small scale analog or keyboard input digital computer to assist in or test parts of model formulation. May supervise other ENGINEERING ANALYSTS (profess. & kin.).

952.382-014 POWER OPERATOR (tel. & tel.) telephone-plant power operator.

Operates and maintains central-office equipment such as motors, generators, storage batteries, and motor-driven apparatus, used to furnish or transmit power for telephone or telegraph operation.

952.382-018 POWER-PLANT OPERATOR (light, heat, & power) power engineer; powerhouse engineer; power-plant engineer.

Operates boilers, turbines, generators, and auxiliary equipment at generating plant to produce electricity: Monitors control board and regulates equipment following recording and indicating instruments. Adjusts controls of water and cold feed systems, blowers, and igniters to start up or shut down boilers. Controls operation of boiler auxiliary equipment, such as water and vacuum pumps, coal driers and pulverizers, steam condensers, and soot blowers to insure efficient operation of boilers. Adjusts boiler controls to provide steam at specified temperature and pressure for turbine loads according to power demands. Adjusts controls to regulate speed, voltage, and phase of incoming turbines to coincide with voltage and phase of power being generated. Synchronizes incoming generating units with units in operation and closes circuit breaker at exact instant of coincidence. Monitors gages to determine effect of generator load on related equipment, such as *bus bars* and voltage regulators. Adjusts transformer controls to regulate flow of power between generating stations and substations. Operates switchgear to regulate and transfer power loads to protect maintenance workers engaged in repairing or cleaning equipment. Records malfunctions of equipment, instruments, or controls on logsheet.

952.362-022 POWER-REACTOR OPERATOR (light, heat, & power) reactor operator; nuclear plant control operator.

Controls nuclear reactor that produces steam for generation of electric power and coordinates operation of auxiliary equipment: Adjusts controls, under supervision, to start and shut down reactor and to regulate flux level, reactor period, coolant temperature, and rate of flow, control rod positions, and other control elements that affect power level within reactor, following standard instructions and prescribed practices. Dispatches orders and instructions to plant personnel through radiotelephone or intercommunication system to coordinate operation of such auxiliary equipment as pumps, compressors, switchgears, and water-treatment systems. May assist in preparing, transferring, loading, and unloading nuclear fuel elements. May be required to hold Nuclear Reactor Operator's license. May be required to hold Radiotelephone Operator's license. May control dual purpose reactors that produce plutonium and steam. May control operation of auxiliary equipment, such as turbines and generators [SWITCHBOARD OPERATOR (light, heat, & power); TURBINE OPERATOR (light, heat, & power).